Byrsonima spicata (Cav.) H.B.K. Maricao

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Byrsonima spicata (Cav.) H.B.K., commonly known as maricao, doncella, bos tan, and golden spoon (*6*), is a medium-sized tree of the West Indies and northern South America. Common in secondary forests, it is a handsome tree (fig. 1) whose foliage is bright green with a few red leaves interspersed and an annual display of yellow flowers. The wood is useful for furniture, trim, and posts.

HABITAT

Native Range

The native range of maricao includes the Greater Antilles (except Jamaica), most of the Lesser Antilles (the U.S. and British Virgin Islands, Antigua, Saba, St. Eustatius, St. Kitts, Montserrat, Guadeloupe, Dominica, Martinique, St. Lucia, St. Vincent, and Barbados), Trinidad, Panama, and northern South America as far south as Bolivia (*4, 9, 12, 22, 30*) (fig. 2). The species is planted as an ornamental in southern Florida (*14*). There is no record of naturalization outside its native range.

Climate

Maricao normally grows in warm, moist environments. In the West Indies, most of the habitat receives 1500 to 3000 mm mean annual precipitation with a short dry season in the spring. Mean monthly temperatures in this region range from 22 °C in January to 27.5 °C in July (*31*). Temperatures in the South American range tend to be slightly warmer and to fluctuate little during the course of the year. In one of the harshest environments of the range, the savannas of Guyana, mean annual temperature is 28 °C, and precipitation ranges from 1400 to 1650 mm per year with a dry season of 7 to 8 months (*10*) in late fall to early spring.

Soils and Topography

Maricao is most abundant and grows best at middle and lower elevations in wet or moist areas (*15*), but the species tolerates diverse conditions. It grows from near sea level to elevations of over 600 m (*12, 22*). Slope is probably not important, although maricao frequently invades areas disturbed by humans, which tend to be on gentle slopes. Sandy or loamy soils with ample soil moisture are probably best, although the species grows on leached sands (*22*) and acid clay ultisols (author, personal observation). Maricao frequently invades eroded and nutrient-depleted farmland after it is abandoned (*16*). The species is mostly confined to acid soils (*4*). Maricao rarely grows on poorly drained or excessively drained sites.

Associated Forest Cover

Maricao is a tree of the moist forest, particularly secondary forest, and it infrequently grows in gaps of the rain forest. In a subtropical moist forest stand in Puerto Rico, maricao is an important subordinate associate of *Hymenaea courbaril* L., *Buchenavia capitata* (Vahl) Eichl., *Manilkara bidentata* (A. DC.) Chev., *Inga fagifolia* (L.) Willd., *Ocotea leucoxylon* (Sw.) Mez, and *Nectandra coriacea* (Sw.) Griseb. (*33*). On abandoned farmland in Dominica, maricao in codominant and intermediate positions comprised 9 percent of the basal area of a stand of *Tabebuia heterophylla* (DC.) Britton, *Simaruba amara* Aubl., *Pithecellobium jupunba* (Willd.) Urb., *M. bidentata,* and Lauraceae (*36*). Maricao, *Byrsonima coccolobiaefolia* H.B.K., and *B. cressifolia* Rich.

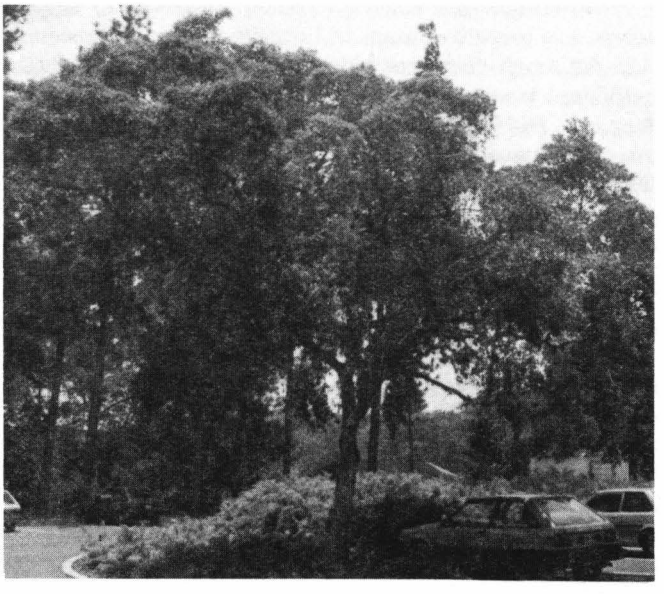

Figure 1.—*Maricao* (Byrsonima spicata) *tree planted as an ornamental in Puerto Rico.*

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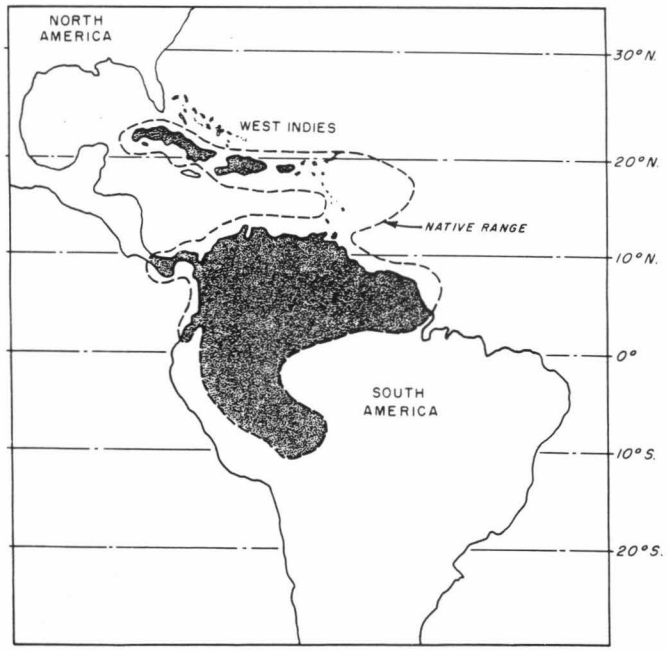

Figure 2.—*Native range of maricao* (Byrsonima spicata) *in the neotropics.*

attain heights of only 2 to 3 m in clumps of savanna forest in Guyana dominated by taller but less abundant *Curatella* sp., *Bowdichia virgilioides* H.B.K., and *Plumeria inodora* Jacq. (*10*).

LIFE HISTORY

Reproduction and Early Growth

Flowering and Fruiting.—Yellow flowers, 7 to 15 mm across, are borne in clumps of 15 to 50 on terminal racemes (*12*). Although each tree blooms in a single annual flush, individual trees can be found blooming during most of the year (*12, 16*). The flowers are slightly scented and attract insect pollinators, especially bees (*16*). Although only a fraction of the flowers set fruit, several hundred fruits can be produced on an open-grown tree. The fruits mature about 5 months after flowering (*22*). Each fruit is a yellow drupe 8 to 20 mm in diameter and contains a hard, toothed stone (*12*). The stone, 7 to 10 mm in diameter, encloses from one to three seeds.

Seed Production and Dissemination.—Upon ripening, the fruits drop to the ground and are dispersed by a number of birds, bats, and wild and domestic terrestrial animals (*14*). If the fruit is not eaten, it will soon rot, and the stone will be in contact with the soil. The bulk of the stones with their enclosed seeds remain under the parent tree (*22*).

Seeds are easily collected from the ground and extracted from the somewhat dry fruit by hand or by mechanical methods. Seeds can be stored for a year or more by air-drying and storing at 4 °C in a sealed container. A batch of 100 air-dried seeds from Puerto Rico averaged 0.321 ± 0.005 g per seed or about 3000 seeds per kilogram (author, personal observation).

Seedling Development.—Germination, which is epigeous, appears to be promoted by certain conditions favorable to the survival of seedlings, such as an opening of the stand or removal of the understory by fire (*22*). Seeds may remain in the soil for as much as a year before germinating (*16*). Germination of seeds in the nursery is erratic. In Puerto Rican tests, the average time to germination was 35 days (*20*). Tests in Trinidad and Tobago yielded zero to 15-percent germination, with a total lack of germination when the seeds were under shade (*22*). Over a 5-month period, one Puerto Rican seedlot gave 35-percent germination under 50-percent shade (author, personal observation). The Puerto Rican nursery tests indicated that seeds stored for several months at room temperature germinated better than fresh seeds (*19, 32*). In a Puerto Rican trial of direct seeding of maricao, broadcast seeding of 9,600 seeds produced no seedlings in 6 months and only 50 at 1 year. On tilled seedspots, only 9 seedlings were present after 6 months from a total of 600 seeds sown (*18*).

Seedlings produce their first pair of leaves when the stems are about 5 cm high (*22*). They can be transplanted without difficulty from germination trays or beds to nursery bags after the first leaves are fully expanded (2.5 cm long). About 6 months in the nursery is required for seedlings to grow to planting size (a 30- to 40-cm height). Planting maricao as bare-root seedlings generally resulted in low survival in Puerto Rico. Top pruning improved results somewhat (*19*). The use of containerized seedlings is recommended to increase survival.

Natural regeneration of maricao can probably best be promoted by the shelterwood or seed tree method in stands that contain maricao. Most of the overstory should be removed, leaving as many maricao seed trees as possible in overstory densities of about 15 m^2/ha. The forest floor should be disturbed during logging or cleared by a light ground fire. As soon as the seedlings have become established, the overstory should be removed. First year growth of natural seedlings may vary from 30 to 90 cm, depending on soil quality and rainfall (*22*).

Boles of maricao tend to be short, and form is sometimes poor, particularly when maricao is open-grown. Initial stand density should be high enough to ensure shade-pruning of lower lateral branches until the merchantable bole is set, and then repeated heavy thinnings should be applied to promote fast growth.

Vegetative Reproduction.—Young maricao trees coppice readily, and the sprouts apparently develop into well-formed trees; older trees to not coppice well (*22*). Root suckering does not occur, and it is not known whether cuttings can be rooted.

Sapling and Pole Stage to Maturity

Growth and Yield.—The growth rate of maricao can be described as moderate. In one small Puerto Rican plantation, dominant trees averaged 1 m in height at 3 years, 2 m in 4 years, 9 m in 10 years, and 12 m in 15 years (*21*). Another small Puerto Rican plantation produced trees 7.6 to 10.2 cm in diameter at breast height (d.b.h.) and 3.7 to 4.6 m in height at 9 years (*19*). In a neglected 45-year-old plantation

of maricao, also in Puerto Rico in an area where maricao now makes up 17 percent of the basal area, maricao averaged 17.4 cm in d.b.h. and 15.4 m in height. The largest maricao, a dominant, was 26.3 cm in d.b.h. and 22.5 m in height (author, personal observation). Release from competition can make a large difference in growth. Periodic annual diameter increment of natural maricao in a thinned stand in Puerto Rico was 0.48 cm/yr compared to 0.16 cm/yr in an unthinned stand (*34*). Maricao appears to attain its maximum size in the Antilles, with d.b.h.'s reaching 50 cm in Puerto Rico (*3*), 60 cm in d.b.h. and 30 m in height in Dominica (*37*), 100 cm in d.b.h. and 36 m in height in Trinidad and Tobago (*22*), 60 cm in d.b.h. in St. Kitts (*5*), and 85 cm in d.b.h. in St. Lucia (*27*). In some parts of its range and in unfavorable habitats, maricao is a small tree with heights of only 2 to 10 m.

In one stand of the subtropical moist (secondary) forest in Puerto Rico, maricao constituted 10 percent of the basal area (*33*). In 1980, the total basal area of maricao in Puerto Rico was estimated at 9,144 m^2, making it the 44th most abundant of about 500 species in terms of basal area (*3*). A forest inventory of the island of St. Lucia revealed that maricao made up 1.3 percent of all 10-cm d.b.h. and larger stems sampled (*27*). The diameter distribution of maricao across Puerto Rico is represented in figure 3. Crown ratios (mean diameter of crown to d.b.h.) of 20 and 25 were reported for codominant and intermediate trees respectively (*36*).

Because of indifferent demand and variable growth rate, commercial planting of maricao is unlikely. However, the species might be planted for the benefit of wildlife and to promote diversity in reforestation projects. Managing maricao already present in secondary forests probably is a good investment. Cleaning and thinning stands would certainly accelerate growth and improve the quality of timber produced, while providing posts and fuelwood.

Rooting Habit.—Seedlings develop a much-branched lateral root system in clayey and medium-textured soils (author, personal observation). Trees have shallow root systems, even in sandy soils (*22*). It does not form buttresses (*37*).

Reaction to Competition.—Maricao is intolerant of shade (*22*), and grows as a pioneer species (*26*) or invades degraded secondary forests (*37*). A few start early enough after disturbance to establish and maintain a dominant canopy position. However, the usual fate in the fierce competition of new stands on abandoned farmland and disturbed secondary forests is eventual relegation to intermediate and suppressed crown positions by faster growing species. Maricao is rarely found in pure stands, generally being a common but minor component of secondary forests. The species is shade-tolerant enough to develop in open stands such as new slow-growing plantations (*22*) and has been regenerated by the shelterwood system (*24*); it will, however, stagnate and eventually die if some overhead light is not maintained. Maricao has been known to invade and suppress plantations of *Calophyllum brasiliense* var. *antillanum* (Britt.) Standl. and *Carapa guianensis* Aubl. (*22*).

It is sometimes desirable to kill maricao during release treatments or site preparation. In a chemical control test where frill girdles were sprayed with a 5-percent solution of 2,4,5-T in diesel oil, 22 of 36 trees died within 6 months (*29*).

Damaging Agents.—Several species of Coleoptera, Homoptera, and Lepidoptera are reported to consume the foliage of maricao (*23*). One insect, *Megalopyge krugii* (Dewitz), is capable of occasionally defoliating whole trees in Puerto Rico. The wood of maricao is very susceptible to drywood termite, *Cryptotermes brevis* (Walker), attack (*35*). Maricao is apparently more resistant to pin-hole borers (any of several genera) than most Puerto Rican woods but is not resistant to marine borers, *Torreda* spp. (*17*). Maricao wood is usually unaffected by sapstain (*17*) and is somewhat resistant to decay (*8*). The average service life of untreated posts 5 to 8 cm thick set in moist soil was 1.4 years, but after a cold soak in 5-percent pentachlorophenol in diesel oil, service life increased to 7.3 years (*7*). Maricao was rated among the best 10 percent of the local species tested for decay resistance. In a 1980 survey of Puerto Rican timber resources, 55 percent of the maricao trees of sawtimber size had form defects that would result in an average 23-percent volume loss as cull. No cull for heart or butt rot was reported for the 355 trees tallied (*1*). Maricao trees appear above average in resistance to breakage in high winds (author, personal observation), but are susceptible to windthrow (*22*).

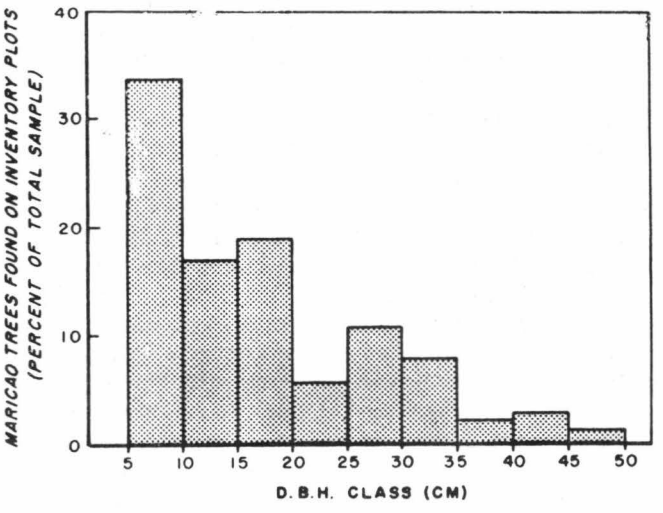

Figure 3.—*Percentages of maricao* (Byrsonima spicata) *trees found on inventory plots across Puerto Rico in 5-cm d.b.h. classes.*

SPECIAL USES

The heartwood of maricao is dark brown to reddish brown with somewhat darker streaks. The contrasting sapwood is gray to light reddish brown (*17*). The wood is hard, heavy, moderately fine textured, and lustrous. The air-dry (15-percent moisture content) density of a Puerto Rican sample was 0.77 g/cm^3 (*17*). Maricao wood seasons at a slow to moderate rate with slight checking and some warping. Shrinkage from green to ovendry wood is 4.0 percent radially, 8.2 percent tangentially, and 12.2 percent volumetrically (*6*). The wood at 12-percent moisture demonstrates a bending strength of 12,400 newtons/cm^2, a modulus of elasticity of 1,300 newtons/cm^2, and a maximum crushing strength of

6,700 newtons/cm^2 (*6*). The wood saws, planes, and sands fairly easily and finishes to a fine surface (*17*). Splitting may occur if screw holes are not drilled to the proper sizes. Both heartwood and sapwood of maricao are used for fancy furniture, cabinetry, turnery, flooring, and trim (*17*). In rural areas, the wood is also used for rough construction, posts, charcoal, and fuel (*8, 11*). The bark has been used for tanning leather (*13*).

Various parts of the tree are employed in folk remedies (*25*). The tree is reported to be a good nectar source for honey bees (*16*). Although the small yellow fruits are somewhat astringent, when ripe they have the flavor of tart apples and are eaten by children as well as by domestic animals and wildlife (*30*). The fruit has a high vitamin C content (*28*), and is sometimes made into liquors and jellies (*14*). To some extent, maricao is used as an ornamental in the West Indies and Florida (*14*). Its hardiness, moderate size, handsome foliage, and annual floral display should draw the attention of homeowners and arborists in the future.

GENETICS

There are about 100 species of *Byrsonima* in tropical America growing as trees, shrubs, and vines (*2*). Maricao has previously been known by the names *Malpighia spicata* Cav., *B. guadaloupensis* Don, *B. coriacea* var. *spicata* (Cav.) Niedenzu (*12*), *B. coriacea* (Sw.) DC., and *B. horneana* Britton & Small (*15*). Maricao appears to hybridize naturally with *B. lucida* (Miller) DC. in Dominica (*12*).

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